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OFFICE OF
PREVENTION, PESTICIDES AND
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Draft Memorandum

DATE:

SUBJECT: Cranberry Benefits Assessment for Diazinon Considering Risks for Mixer, Loader, and Applicator

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SUMMARY

Cranberries are a high-value perennial crop grown in five states on approximately 37,000 acres. Based on available published data and personal communications with crop experts, BEAD believes that localized yield reductions of 10 to 12.5 percent can occur if diazinon is not available.

To provide an upper bound estimate of the impacts of the application risk, BEAD estimated the impacts from a worst-case scenario for Oregon, Washington and Wisconsin.

BACKGROUND

The American Cranberry (*Vaccinium macrocarpon*) is a low growing, creeping woody perennial shrub. The plant spreads vegetatively via horizontal stems (runners). Vertical shoots (uprights) from the leaf axils of the runners produce flowers that give rise to clusters of cranberry fruit. Cranberries are produced in Massachusetts, Wisconsin, New Jersey, Oregon, Washington, Rhode Island, Maine, and Connecticut.

The annual growth cycle of the cranberries in Massachusetts is typical of that for the crop, although the calender dates may vary due to geography and cranberry variety. Cranberry plants have a dormant season that usually lasts from November through April. After emerging from dormancy in May, vines develop new leaves. Flowering begins in mid June and the bloom lasts for three to six weeks. Berries reach maturity about 80 days after flowering and are harvested from early September through early November (USDA, 2001).

Cranberry beds range in size from less than an acre to over 200 acres. Originally, cranberry beds were built in natural wetlands by draining peat bogs. Once drained, the bogs were cleared of vegetation, leveled, and covered with sand and then planted with cranberry vines. Because of environmental regulations protecting wetlands, all new beds are built in more "upland" sites that are engineered to match hydrological and soil characteristics of the traditional bogs. Once established and properly maintained, beds may remain productive for more than 50 years.

Several cultural practices are important in maintaining the productivity of established cranberry beds. Beds are pruned by machine after harvest to stimulate the production of the uprights and to reduce the matting of the runners. Sanding involves the application of a ½ to 2 inch layer of sand to the bed every 3 to 4 years. This layer increases the rooting of the vines, improves drainage, reduces danger from frost injury, and aids in pest control by changing the organic material and the microhabitat of the overwintering insects. Water management is used not only to irrigate the crop, but is also used for pest control by this change in microhabitat.

Cranberries are harvested by two methods. Dry harvesting uses a picking machine that combs the fruit off the vines. This machine, about the size of a large self-propelled lawn mower, is operated by a worker walking behind the machine. Water harvesting involves flooding the beds just prior to harvest. A water-reel is used to knock the fruit off the vines. The buoyant berry rises to the surface and is moved with floating booms to the corner of the bed and is loaded into trucks with conveyer belts or pumps. Typically, dry harvested cranberries are sold into the fresh market and water harvested cranberries are sold to processors because the fruit is often damaged during harvest and may be more susceptible to bruising and pathogens. The great majority of cranberries are water harvested.

Cranberries are grown commercially primarily in five U.S. States. In the Northeast, the major cranberry states are Massachusetts and New Jersey (with minor acreage in Rhode Island, Maine, and Connecticut). Massachusetts and New Jersey produced 2,396,000 and 2,566,000 barrels on 18,300 and 18,800 acres in 1998 and 1999, respectively. In the Midwest, Wisconsin produced 2,252,000 and

3,340,000 barrels on 14,500 and 14,600 acres in 1998 and 1999, respectively. In the Pacific Northwest, Oregon and Washington produced 523,000 and 467,000 barrels on 3,800 and 3,900 acres in 1998 and 1999, respectively (NASS, 2000).

The National Agricultural Statistics Service forecasts the 2000 cranberry crop to be 5.84 million barrels (1 barrel = 100 pounds or 1 cwt), down 8 percent from 1999 but 7 percent above 1998. The value of the cranberry crop was 211 million dollars in 1998 and 108 million dollars in 1999 (NASS, 2000). This amounts to a 48 percent reduction in value in one year. Personal communication with crop experts indicate that this rapid drop in price resulted from increased production and inelastic demand for cranberry products.

USE OF DIAZINON ON CRANBERRIES

Diazinon: – The use of diazinon appears to be stable in the U.S. An average of 64 percent of the total cranberry acres were treated with diazinon in 1996, 65 percent in 1998 and 70 percent in 2000 (USDA, 2001; Downing and Deziel, 1999) (Table 1).

Table 1. Percent Cranberry Acreage Treated with Diazinon (USDA, 2001; Downing and Deziel, 1999, 2000).

State	1996		1998		2000	
	Acreage	Percent Crop Treated	Acreage	Percent Crop Treated	Acreage	Percent Crop Treated
New Jersey	3,917	9	3,795	1.3	3958	0.5
Massachusetts	14,194	75	13,370	77	13,669	98
Wisconsin	12,381	72	14,211	70	16,185	59
Oregon	2,079	57	2,121	61	2,386	72
Washington	1,513	55	1,617	74	1,726	98
United States (Total)	34,084	64	35,114	65	37,667	70

Target Pests of Diazinon in the United States

BEAD has been told that in the United States diazinon is targeted at: cranberry tipworm (Dasineura oxycoccana), cranberry girdler (Chrysoteuchia topiaria), blackheaded fireworm (Rhopobota naevana), cranberry fruitworm (Acrobasis vaccinii), cranberry flea beetle (Systena frontalis), and the striped colaspis (Colaspis costipennis). Of these pests diazinon is a critical component for the control of two key pests the cranberry tipworm and the cranberry girdler. There are no efficacious alternatives for either of these pests. Diazinon is applied as a 14% granule formulation then watered in under a 24(c)

registration for the control of cranberry tipworm in: Massachusetts, New Jersey, Oregon, Washington, and Wisconsin.

Table 2. Diazinon Target Pests and Alternatives

Pest	Alternatives	
cranberry tipworm	***none***	
cranberry girdler	***none***	
cranberry fruitworm	acephate phosmet tebufenozide	chlorpyrifos carbaryl
blackheaded fireworm	acephate phosmet pyrethrin	chlorpyrifos carbaryl tebufenozide
cranberry flea beetle	carbaryl	
cutworms	acephate carbaryl	chlorpyrifos
striped colaspis	carbaryl	

Use in the Northeast Region (Massachusetts and New Jersey)

Target pests: The use of diazinon is increasing in Massachusetts and declining in New Jersey. The target pests in New Jersey and Massachusetts are similar to the list for the United States. Some key pests that diazinon is used on in these areas are: cranberry tipworm, cranberry girdler, blackheaded fireworms, cranberry fruitworm, cranberry flea beetle, cutworms such as false armyworms (Xylena nupera) and blossom worms (Epiglaea apiata), green spanworm (Itame sulphurea), and striped colaspis. The critical pests in this area are the cranberry tipworm and the cranberry girdler (Section 24(c) registration). Because these pests are effectively controlled with diazinon, estimates of potential yield loss are not available from this region. However, estimates from Oregon suggest that the cranberry girdler infestation can lead to 25% yield losses under heavy infestations.

Alternative Pest Control Methods: There are several other insecticides that are used on cranberries in Massachusetts and New Jersey for these pests, including acephate, chlorpyrifos, carbaryl, pyrethrins, phosmet, and tebufenozide (USDA, 2000a). BEAD has no data on the relative effectiveness of these alternatives.

A number of insecticides that are potential replacements for organophosphate insecticides have recently been registered or are progressing toward registration. Recently registered insecticides include

tebufenozide and Bacillus thuringiensis. Insecticides in review for registration include methoxyfenozide, spinosad, and imidacloprid (USDA, 2001). Additionally, advance testing of newer insecticides for use on cranberries is being done for emamectin benzoate and indoxacarb (USDA, 2001). These new insecticides will not provide the same spectrum of insect control as the organophosphates and may need to be applied in combination with other products to provide a similar range of pest control.

Several cultural control methods may be used to suppress or control populations of some of these pests in cranberries. Sanding, the spreading of a ½ to 2 inch layer of sand over the cranberry vines, reduces infestations of cranberry girdler, green spanworm, and cranberry tipworm. It also increases the effectiveness of insecticides in general by burying the organic trash layer so there is less insecticide binding to organic matter on the bed surface. Further, good sanitation in the bed and around its perimeter helps reduce pest populations by removing the weeds that serve as alternative hosts for insect pests.

The traditional method of pest control in cranberries is controlled flooding at various times throughout the growing season. Logistic problems (e.g., availability of adequate water supplies, type of bed) may prevent the use of controlled flooding in some areas. Existing populations of cranberry pests that can be controlled by flooding include sparganothis fruitworm, cranberry fruitworm, cutworms, false armyworm, green spanworm, fireworms, cranberry scale, and mites. Recent changes in the timing of winter flood removal have reportedly increased pest populations (USDA, 2000a). BEAD believes that this early removal of the winter flood is prompted by growers trying to increase their cranberry revenues by "shifting" the crop cycle by two to three weeks – resulting in an earlier harvest and a higher yield.

Biological control agents that are available for cranberry pests include a mating disruption pheromone for the control of the blackheaded fireworm and sparganothis fruitworm. Insecticidal nematodes are commercially available for some of the soil-inhabiting pests (USDA, 2001). Use of these biological control agents has not led to a significant reduction in pesticide usage.

Use in the Central Region (Wisconsin)

Target Pests: The use of diazinon was stable but is decreasing in Wisconsin. The primary use of diazinon in Wisconsin is to control blackheaded fireworm, cranberry girdler, cranberry fruitworm, and cranberry tipworm. The cranberry girdler can lead to dead plants in the field and under heavy infestations can produce "dead spots". The impact for individual growers can be high but information was not available to quantify it. The cranberry tipworm is considered a regional pest in Wisconsin causing minor damage in the southern part of the state with losses increasing to 10 to 20% in the north.

Alternative Pest Control Methods: There are no alternatives for the cranberry girdler or the cranberry tipworm in Wisconsin. A number of other chemicals are used in for the other insect pests and the list is similar to the Northeast region above. Biological and cultural controls are discussed above in the "Use in the Northeast Region" section and in the crop profile (USDA, 1998).

Use in the Western Region (Oregon and Washington)
Diazinon use is increasing in Oregon and Washington. The primary use of diazinon in Oregon and Washington is to control blackheaded fireworm and cranberry girdler. Yield losses as high as 25% have occurred in Oregon when the cranberry girdler is not controlled (discussion with local experts). This pest attacks the crown of the cranberry plant leading to death of the plant requiring replanting of individual plants. This creates a problem for the grower because newly planted cranberries must have the water and fertility managed differently than established plants. Alternatives exist for the blackheaded fireworm but there are no effective alternatives for the cranberry girdler (section 24(c) registration). Biological and cultural controls are discussed above in the "Use in the Northeast Region" section and in the crop profiles (USDA, 1999a, 1999b).

For this analysis, BEAD has selected a 10 percent yield reduction for Washington and Oregon and 12.5 percent yield reduction for Wisconsin. These percentages represent the lower level of impacts due to the loss of diazinon not the maximum projected yield loss. But, in our assessment the impacts are being extrapolated across all the acres treated with diazinon not just the highly infested acres.

IMPACTS RELATED TO MIXER, LOADER, APPLICATOR RISKS

ECONOMIC IMPACT ASSESSMENT

This analysis focuses only on the pest impacts for which no alternatives are available for growers if diazinon use is cancelled. The impacts are measured at the per acre level, the state or regional level and the industry level. The cancellation is based on potential risks to mixer loader and applicator risks that cannot be mitigated.

An exhaustive search by BEAD of the literature on the World Wide Web for cranberry crop budgets was not successful. Instead, to measure impacts, BEAD sought USDA, NASS and proprietary data as well as expert opinion to determine the economic impact on gross revenues of a diazinon cancellation on producers of cranberries. Estimated production costs were obtained from the Cranberry Institute and average nationally are estimated to be about $25 per hundred weight. A hundred weight or CWT is equivalent to 1 barrel. However, the cost of production currently exceeds the expected market price, which this year is targeted for approximately $20 per hundred weight. These costs reflect the national average operating costs and do not include overhead and other opportunity costs. This analysis assumes that cranberry growers will not drastically change their production practices and that the prices received by the grower are not affected by any production changes or by growers currently operating at a loss. The reason for the low market price is because during the late 1990's, market prices averages around $50 per barrel and reached prices as high as $70 per barrel. As more producers harvested land brought into production, the supply of cranberries outstripped the demand. Currently, producers are facing reduced marketing orders as major processors of cranberries have reduced their demand.

The states that currently use diazinon and for which no alternative is available to control either cranberry girdler or the cranberry tipworm are Oregon, Washington and Wisconsin. Oregon and Washington growers are facing the possibility of no alternative for the cranberry tipworm. Wisconsin growers are facing the possibility of no alternative to control the cranberry girdler.

Per Acre Impact

To estimate economic impacts, acreage in production, yield, price and yield loss data, shown below in Table 3 were utilized to determine gross returns and impacts per acre for Oregon, Washington and Wisconsin.

Table 3. Cranberry acreage, percent crop treated, yield, and revenue per acre with and without diazinon.

State	2000							
	Acreage	Percent Crop Treated	Yield Per Acre (CWT)	$ Per CWT*	Gross Revenue	Yield Loss (%)	Maximum Yield Loss Impact ($)	Per Acre Impact
Wisconsin	16,185	59	133	$20	$43,052,100	12.5	$5,381,513	$333
Oregon	2,386	72	128	$20	$6,108,160	10	$610,816	$256
Washington	1,726	98	128	$20	$4,418,560	10	$441,856	$256
United States (Total)	37,667	70	Average: 130.5	$20	$98,310,870			

* $ per CWT are based on Cranberry Institute market price projections for 2002.
Source: BEAD calculations.

State Impact

Yield impacts at the state level are reflective of the maximum potential crop loss due to the cancellation of diazinon (see Table 3). For Wisconsin, a yield loss of 12.5 percent due to cranberry girdler will result in a maximum yield loss impact of $5,381,513. For Oregon, a yield loss of 10 percent due to cranberry tipworm will result in a maximum yield loss impact of $610,816 and for Washington a yield loss due to cranberry tipworm of 10 percent will result in a maximum yield loss impact of $441,856.

Industry/National Impact

Based on 2000 production and percent crop treated data, Diazinon is used on approximately 70 percent or 26,367 acres of the 37,667 acres in production. The estimated national average yield in barrels per acre is approximately 130.5. Assuming the target price of $20 per barrel is multiplied by

the number of barrels per acre (130.5) and the product is multiplied by the total acres in production (37,667), an estimate of the industry's gross revenue is obtained which as illustrated in Table 3 is $98,310,870. Given the estimated gross revenue losses in Oregon, Washington and Wisconsin aggregated and divided by the national estimate of gross value, ($6,434,185/$98,310,870) yields a 6.5 percent loss in gross value nationally. Losses attributable to cranberry girdler which is a problem in Wisconsin accounts for approximately 5.5 percent of the national or industry loss in gross revenue while the cranberry tipworm which is a problem only in Oregon and Washington accounts for approximately, 1 percent of the national loss in gross revenue. See Table 4 for the pest impacts on cranberries and the estimated dollar loss nationally.

Table 4. Pest Impacts on Cranberries

Pest	Maximum Potential Crop Yield Loss	Dollar Loss	Percent of National Gross Revenue
cranberry girdler	12.5	$5,381,513	5.5
cranberry tipworm	10	$1,052,672	1

Source: BEAD calculations.

To extrapolate the average yield loss BEAD took the maximum potential yield loss and calculated it to apply to one half of the treated acres. Therefore, with maximum estimated yield losses for the Cranberry girdler estimates in the Pacific Northwest of 25% and for cranberry tipworm from Wisconsin of 20% BEAD calculated the total impact as 12.5% yield loss for the cranberry girdler and 10% yield loss for the cranberry tipworm.

CONCLUSION

Based on available published data and personal communication with crop experts, BEAD believes the economic impact to affected individual acres could be as high as 10 to 12.5 percent of their yields for growers in Oregon and Washington and Wisconsin respectively. At the state level, the economic impact is about 12.5 percent of gross revenues for Wisconsin and 10 percent for Oregon and Washington. At the national level, this worst-case scenario could equate to 6.5 percent loss in gross revenues.

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